

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Chang-ho CHO et al.

Serial No. 10/773,289

Filed: February 9, 2004

For: INK-JET PRINTHEAD AND
METHOD FOR MANUFACTURING THE SAME



Art Unit: 2853

Examiner: An H. Do

Confirmation No. 8742

Attorney Docket No. 249/445

TRANSMITTAL OF APPEAL BRIEF

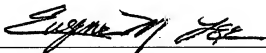
Commissioner for Patents
P.O. Box 1450
Alexandria, VA. 22313-1450

Sir:

This Appeal Brief is being filed in triplicate together with the fee as set forth in 1.17 (c) in the amount of \$500.00 covering the appeal fee. The Commissioner of Patents is hereby authorized to charge the necessary fees to our credit card. Attached is PTO form 2038.

Respectfully submitted,
LEE & MORSE, P.C.

Date: April 20, 2007



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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

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Art Unit: 2853

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BRIEF ON APPEAL UNDER 37 C.F.R. § 1.192

Commissioner for Patents
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Randolph Building
401 Dulany Street
Alexandria, Virginia 22314

Date: April 20, 2007

Sir,

INTRODUCTORY COMMENTS

This is an appeal to the Board of Patent Appeals and Interferences from the decision of the Examiner of Art Unit 2853 who, in an Office Action Made Final mailed October 26, 2006, finally rejected claims 1, 2 and 4-12 in the above-identified application. Appellants respectfully request consideration of this Appeal Brief by the Board of Patent Appeals and Interferences for reversal of the Examiner's rejection of claims 1, 2 and 4-12.

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I. REAL PARTY IN INTEREST

The invention is assigned to Samsung Electronics Co., Ltd., 416 Maetan-dong, Yeongtong-gu, Suwon-si, Gyeonggi-do, Republic of Korea.

II. RELATED APPEALS AND INTERFERENCES

To the best of appellants' knowledge, there are no prior or pending appeals, interferences or judicial proceedings which may be related to, directly affect or be directly affected by, or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF THE CLAIMS

Claims 1, 2 and 4-18 are pending in the subject application, of which claims 13-18 have been withdrawn in view of a restriction requirement mailed April 21, 2006. Claims 1, 2 and 4-12 are finally rejected. A copy of claims 1, 2 and 4-18 is set forth in the attached Claims Appendix.

Claims 1, 2 and 4-12 are on appeal. Of these, claim 1 is the sole independent claim.

IV. STATUS OF AMENDMENTS

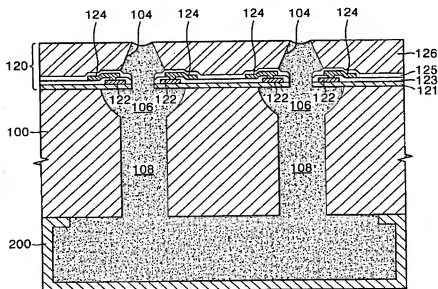
On December 19, 2006, appellants filed an Amendment under 37 C.F.R. § 1.116 in response to the Office Action Made Final of October 26, 2006. The Amendment under 37 C.F.R. § 1.116 made a single amendment cancelling claim 3. In an Advisory Action mailed January 9, 2007, the Examiner indicated that the Amendment under 37 C.F.R. § 1.116 had been entered and claim 3 had been cancelled. No other amendments to the application have been made. Accordingly, apart from the cancellation of claim 3, the claims set forth in the Claims Appendix correspond to those addressed by the Examiner in the Office Action Made Final mailed October 26, 2006.

V. SUMMARY OF CLAIMED SUBJECT MATTER

The claims on appeal generally relate to an ink jet printhead. The ink jet printhead of the present invention is a back-shooting type, in which a bubble formed in the ink expands in

a direction that is generally opposite to the direction in which ink is ejected from the printhead.¹ An ink jet printhead according to an exemplary embodiment of the present invention is illustrated in drawing FIG. 6 of the application, which is reproduced below.

Drawing FIG. 6



As illustrated in drawing FIG. 6, a heater 122 disposed in a nozzle plate 120 generates heat to form a bubble in ink in an ink chamber 106. The bubble formed in the ink chamber 106 initially expands in a direction opposite to that of the nozzle plate 120, i.e., the bubble initially expands downward in drawing FIG. 6. The expanding bubble increases pressure in the ink chamber 106, causing ink to be expelled through a nozzle 104 in the nozzle plate 120. The ink jet printhead also includes a restrictor 108 that supplies ink directly to the ink

¹ See the instant application at, e.g., paragraph [0070] (page 19, line 17 to page 20, line 6).

chamber 106 from a reservoir 200, and which restricts reverse flow of ink from of the ink chamber 106 toward the reservoir 200 during ink ejection.²

As illustrated in drawing FIG. 6, the restrictor 108 penetrates the lower surface of the substrate 100 so as to be in direct communication with the reservoir 200, i.e., there is no manifold disposed between the restrictor 108 and the reservoir 200. This design significantly simplifies manufacture of the ink jet printhead using photolithographic techniques. It will be appreciated that photolithographic techniques are generally more accurate when a surface to be processed is planar and is in close proximity to the photolithographic equipment. The absence of a manifold below the restrictor 108 provides a planar surface of the substrate 100, such that a region in which the restrictor 108 is to be formed is positioned at the outermost portion of the substrate 100. Thus, fabrication accuracy can be improved.³

The restrictor 108 also provides a restriction against the reverse flow of ink during operation of the ink jet printhead. It will be appreciated that, absent the restrictor 108, during ink ejection the expanding bubble would have a tendency to push a portion of the ink away from the nozzle plate 120, i.e., to displace the ink backward in the ink flow channel. Such a displacement is undesirable since, rather than ejecting ink from the nozzle 104, ink would be displaced in a direction opposite to the nozzle 104. Thus, by limiting reverse flow, the restrictor 108 significantly improves the efficiency of ink ejection.⁴

² See the instant application at, e.g., paragraph [0051] (page 15, lines 1-10).

³ See the instant application at, e.g., paragraph [0018] (page 6, line 10 to page 7, line 25) and paragraph [0070] (page 19, line 17 to page 20, line 6).

⁴ See the instant application at, e.g., paragraph [0010] (page 3, lines 13-16) and paragraph [0070] (page 19, line 17 to page 20, line 6).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1, 2 and 4-12 stand finally rejected as follows:

- a) claims 1, 2 and 4-12 stand rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-2, 4-7 and 9 of U.S. Patent No. 6,886,919 to Lim et al. (hereinafter referred to as “the Lim et al. reference”) in view of U.S. Patent No. 5,841,452 to Silverbrook (hereinafter referred to as “the Silverbrook reference”) and U.S. Patent No. 5,710,070 to Chan (hereinafter referred to as “the Chan reference”);
- b) claims 1, 2, 5, 6 and 8 stand rejected under 35 U.S.C. § 102(b) as being anticipated by the Silverbrook reference;
- c) claim 4 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over the Silverbrook reference in view of the Chan reference; and
- d) claim 7 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over the Silverbrook reference in view of U.S. Patent Publication No. 2002/0008738 to Lee et al. (hereinafter referred to as “the Lee et al. reference”).⁵

Appellants respectfully submit that each of these rejections is improper.

On appeal, regarding the rejection of claims 1, 2 and 4-12 on the ground of nonstatutory obviousness-type double patenting as being unpatentable over the Lim et al.

⁵ See the Office Action Made Final mailed October 26, 2006, paragraph no. 1, pages 2-7; paragraph no. 3, pages 7-9; paragraph no. 5, page 9; and paragraph no. 6, page 10.

reference in view of the Silverbrook and Chan references, appellants stipulate that the rejection of claims 2 and 4-12 stands or falls with the rejection of claim 1.

Additionally, on appeal, regarding the rejection of claims 1, 2, 5, 6 and 8 under 35 U.S.C. § 102(b) as being anticipated by the Silverbrook reference, appellants stipulate that the rejection of claims 2, 5, 6 and 8 stands or falls with the rejection of claim 1.

For the purposes of this appeal, appellants present the following grounds of rejection for review:

- a) whether claim 1 is unpatentable on the ground of nonstatutory obviousness-type double patenting over claims 1-2, 4-7 and 9 of the Lim et al. reference in view of the Silverbrook and Chan references;
- b) whether claim 1 is unpatentable under 35 U.S.C. § 102(b) as being anticipated by the Silverbrook reference;
- c) whether claim 4 is unpatentable under 35 U.S.C. § 103(a) over the Silverbrook reference in view of the Chan reference; and
- d) whether claim 7 is unpatentable under 35 U.S.C. § 103(a) over the Silverbrook reference in view of the Lee et al. reference.

VII. ARGUMENT

A. The Rejection of Claim 1 as Being Unpatentable on the Ground of Obviousness-type Double Patenting is Improper

Claim 1 stands rejected as being unpatentable on the ground of nonstatutory obviousness-type double patenting over claims 1-2, 4-7 and 9 of the Lim et al. reference in view of the Silverbrook and Chan references. Appellants respectfully submit that this rejection is improper and should be reversed.

The Examiner has rejected claim 1 on the ground of obviousness-type double patenting. Accordingly, the Examiner is required by law to demonstrate that claim 1 is not

patentably distinct from the subject matter claimed in the Lim et al. reference in view of the Silverbrook and Chan references.⁶ An obviousness-type double patenting rejection is analogous to the nonobviousness requirement of 35 U.S.C. § 103. Therefore, the analysis employed in an obviousness-type double patenting rejection parallels the guidelines for analysis of a 35 U.S.C. § 103 obviousness determination, and, thus, the factual inquiries set forth in Graham v. John Deere Co. are employed in the obviousness-type double patenting analysis.⁷ A *prima facie* case of obviousness is established when the teachings from the prior art⁸ itself would appear to have suggested the claimed subject matter to a person of ordinary skill in the art.⁹ In particular, the Examiner must show that all of the claim limitations are taught or suggested by the prior art.¹⁰

Claim 1 of the instant application recites, *inter alia*, a restrictor. Appellants respectfully submit that the cited references, taken as a whole, fail to disclose, or even suggest, this aspect of claim 1. Therefore, no *prima facie* case of obviousness has been made out with respect to claim 1.

⁶ See, e.g., the Manual of Patent Examining Procedure, 8th ed., rev. 5 (Aug. 2006) § 804 (II)(B)(1). (Hereinafter, unless noted otherwise, all references to the “MPEP” will be to the 8th ed., rev. 5).

⁷ *Id.*

⁸ Appellants note that the Lim et al. reference is not prior art. However, the analysis employed for the obviousness-type double patenting rejection parallels that of a prior art-based rejection under 35 U.S.C. § 103. Therefore, for clarity, the term “prior art” will be used herein.

⁹ *In re Bell*, 991 F.2d 781, 783, 26 USPQ2d 1529 (Fed. Cir. 1993), quoting *In re Rinehart*, 531 F.2d 1048, 1051, 189 USPQ 143, 147 (CCPA 1976).

¹⁰ *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974).

1. The Lim et al. reference fails to disclose or suggest a restrictor

Appellants respectfully submit that the Lim et al. reference fails to disclose or suggest a restrictor, as recited in claim 1. In the Office Action Made Final, the Examiner alleged that the claims of the Lim et al. reference “contain the basic elements of the claimed limitations of the pending application” and presented a table comparing claim 1 of the Lim et al. reference to claim 1 of the instant application.¹¹ The comparison is reproduced below in Table 1.

Table 1

<u>Patent Claims</u>	<u>Pending Claims</u>
<p>1. A monolithic ink-jet printhead, comprising:</p> <p>a substrate having an ink chamber to be supplied with ink to be ejected, a manifold for supplying ink to the ink chamber, and an ink channel in communication with the ink chamber and the manifold;</p> <p>a nozzle plate including a plurality of passivation layers stacked on the substrate and a heat dissipating layer stacked on the plurality of passivation layers; a nozzle, including a lower part and an upper part, the nozzle penetrating the nozzle plate so that ink ejected from the ink chamber is ejected through the nozzle;</p> <p>a heater provided between adjacent passivation layers of the plurality of</p>	<p>1. (Original) An ink-jet printhead, comprising:</p> <p>a substrate;</p> <p>an ink chamber to be filled with ink to be ejected formed on an upper surface of the substrate;</p> <p>a restrictor, which is a path through which ink is supplied from an ink reservoir to the ink chamber, perforating a bottom surface of the substrate and a bottom surface of the ink chamber;</p> <p>a nozzle plate, which is stacked on the upper surface of the substrate and forms an upper wall of the ink chamber;</p> <p>a nozzle perforating the nozzle plate at a position corresponding to a center of the ink chamber;</p> <p>a heater formed in the nozzle plate to surround the nozzle; and</p>

¹¹ Office Action Made Final mailed October 26, 2006, paragraph no. 1, page 5. The Examiner asserted that claim 1 of the instant application, and the claims depending therefrom, are unpatentable over claims 1, 2, 4-7 and 9 of the Lim et al. reference. However, claims 2, 4-7 and 9 of the Lim et al. reference only recite features of a nozzle plate. Thus, only claim 1 of the Lim et al. reference is considered pertinent to appellants' arguments regarding the failure of the Lim et al. reference to disclose or suggest a restrictor as recited in claim 1 of the instant application.

<p>passivation layers of the nozzle plate, the heater being located above the ink chamber for heating ink within the ink chamber; and</p> <p>a conductor between adjacent passivation layers of the plurality of passivation layers of the nozzle plate, the conductor being electrically connected to the heater for applying current to the heater, wherein the heat dissipating layer is made of a thermally conductive metal for dissipating heat from the heater, the lower part of the nozzle is formed by penetrating the plurality of passivation layers, and the upper part of the nozzle is formed by penetrating the heat dissipating layer in a tapered shape in which a cross-sectional area thereof decreases gradually toward an exit thereof.</p>	<p>a conductor for applying a current to the heater.</p>
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Table 2 presents a closer look at the comparison relied upon by the Examiner.

Table 2

<u>Patent Claims</u>	<u>Pending Claims</u>
<p>a substrate having an ink chamber to be supplied with ink to be ejected,</p> <p>a manifold for supplying ink to the ink chamber, and</p> <p>an ink channel in communication with the ink chamber and the manifold;</p>	<p>a substrate;</p> <p>an ink chamber to be filled with ink to be ejected formed on an upper surface of the substrate;</p> <p>a restrictor, which is a path through which ink is supplied from an ink reservoir to the ink chamber, perforating a bottom surface of the substrate and a bottom surface of the ink chamber;</p>

Referring to Table 2, claim 1 of the Lim et al. reference recites an ink channel in communication with an ink chamber and a manifold, whereas claim 1 of the instant application recites a restrictor perforating a bottom surface of a substrate and a bottom surface of an ink chamber. However, the ink channel recited in claim 1 of the Lim et al. reference fails to suggest the restrictor recited in claim 1 of the instant application. The restrictor

recited in claim 1 of the instant application functions to increase flow resistance in a the direction of bubble growth, so that energy delivered to the ink by the expanding bubble is more efficiently used to eject ink from the nozzle.¹² In contrast, the Lim et al. reference fails to suggest that the ink channel described therein acts as a restrictor, and fails to discuss flow resistance of the ink channel. Indeed, the Lim et al. reference fails to even suggest that reverse flow is a problem, despite the fact that the reference provides a detailed description of the ink ejection mechanism. Thus, the Lim et al. reference fails to suggest the need for a restrictor. Therefore, since the Lim et al. reference fails to describe a restrictor and fails to even suggest that reverse flow may be mitigated by a restrictor, appellants respectfully submit that the Lim et al. reference fails to disclose or suggest the restrictor recited in claim 1 of the instant application.

2. The Silverbrook reference fails to disclose or suggest a restrictor

Appellants respectfully submit that the Silverbrook reference fails to disclose or suggest a restrictor, as recited in claim 1. In the Office Action Made Final, the Examiner equated a nozzle channel 114 that is described in the Silverbrook reference to the restrictor recited in claim 1 of the instant application.¹³ However, appellants respectfully submit that the nozzle channel 114 fails to disclose, or even suggest, the restrictor recited in claim 1.

In particular, appellants respectfully submit that the Silverbrook reference fails to even suggest that the nozzle channel 114 acts as a restrictor, and fails to discuss flow resistance of the nozzle channel 114. Indeed, as was the case with the Lim et al. reference, the Silverbrook

¹² Application as filed, page 15, paragraph [0051].

¹³ Office Action Made Final, paragraph no. 7, page 12, "Response to Arguments."

reference fails to even suggest that reverse flow is a problem, or that reverse flow may be mitigated by a restrictor. Moreover, it is clear that the nozzle channel 114 cannot function as a restrictor, because it is significantly *larger* than the adjoining nozzle barrel 113 and, thus, would enhance, rather than restrict, the reverse flow of ink out of the nozzle barrel 113.¹⁴ Therefore, since the Silverbrook reference fails to describe a restrictor and fails to even suggest that reverse flow may be mitigated by a restrictor, appellants respectfully submit that the Silverbrook reference fails to disclose or suggest the restrictor recited in claim 1 of the instant application.

3. The Chan reference fails to disclose or suggest a restrictor

Appellants respectfully submit that the Chan reference fails to disclose or suggest a restrictor, as recited in claim 1. In the Office Action Made Final, the Examiner did not argue that the Chan reference discloses or suggests the restrictor recited in claim 1 of the instant application, and appellants respectfully submit that, as with the Lim et al. and Silverbrook references discussed above, the Chan reference fails to suggest that reverse flow is a problem, or that reverse flow may be mitigated by a restrictor. Therefore, appellants respectfully submit that the Chan reference fails to disclose or suggest the restrictor recited in claim 1 of the instant application.

¹⁴ See the Silverbrook reference at col. 6, lines 11-19, which states that the nozzle channel 114 has an area of over 6 times that of the adjoining nozzle barrel 113 (a nozzle channel cross-sectional area of 7852 microns² as compared to a nozzle barrel cross-sectional area of 1256 microns², where nozzle channel dia. = 100 microns and nozzle barrel dia. = 40 microns; flow is proportional to the cross-sectional area of the feature, i.e., πr^2 , for a circular feature, where r is the radius of the feature). See also drawing FIGS. 9 and 17, which clearly show that the nozzle channel 114 is significantly larger than the adjoining nozzle barrel 113.

4. The cited references, taken as a whole, fail to disclose or suggest a restrictor

Appellants respectfully submit that the cited references, taken as a whole, fail to disclose or suggest the restrictor recited in claim 1 of the instant application. None of the references even mention a restrictor and none of the references suggest that reverse flow is a problem. Accordingly, one of ordinary skill in the art, having read the cited references, would fail to appreciate that reverse flow of ink is a problem that may be mitigated by a restrictor. Therefore, appellants respectfully submit that one of ordinary skill in the art would not be motivated to modify the printhead claimed in the Lim et al. reference to arrive at the ink jet printhead recited in claim 1 of the instant application.

In the Office Action Made Final, the Examiner asserted that appellants had failed to overcome the Examiner's arguments because appellants had argued against the references individually, citing *In re Keller*.¹⁵ Appellants respectfully disagree. Rather than attacking the references individually, appellants have pointed out fatal flaws in the Examiner's arguments, e.g., the failure of the Examiner to identify a teaching in *any* of the cited references that suggests, *inter alia*, the problem to be solved by the restrictor recited in claim 1, much less suggesting the restrictor itself. Where, as here, not one of the cited references identifies the problem or the solution, it cannot be said that the prior art as a whole is greater than the sum of the individual parts. Therefore, appellants' arguments regarding the individual references make clear that the purported motivation to modify the teachings of the Lim et al. reference

¹⁵ Office Action Made Final mailed October 26, 2006, paragraph no. 7, page 11, citing *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981).

does not derive from the teachings of the prior art as a whole, but rather is the exclusive product of hindsight reconstruction on the part of the Examiner.

In view of the above, appellants respectfully submit that the Examiner has failed to establish a *prima facie* case of obviousness with respect to claim 1. Therefore, the rejection of claim 1 of the instant application as being unpatentable on the basis of obviousness-type double patenting over the claims of the Lim et al. reference is improper, and appellants respectfully request that it be reversed.

B. The Rejection of Claim 1 as Being Anticipated by the Silverbrook Reference is Improper

Claim 1 stands rejected as being unpatentable under 35 U.S.C. § 102(b) as being anticipated by the Silverbrook reference. Appellants respectfully submit that this rejection is improper and should be reversed.

A claim may be anticipated only if each and every element set forth in the claim is found, either expressly or inherently, in a single prior art reference.¹⁶ However, the Silverbrook reference fails to disclose, or even suggest, the restrictor recited in claim 1 of the instant application.

In the Office Action Made Final, the Examiner asserted that the Silverbrook reference shows, *inter alia*,

a restrictor [114], which is a path through which ink is supplied from an ink reservoir (beneath [114], any printhead has a reservoir to supply ink to the nozzle) to the ink chamber [112 and 113], perforating

¹⁶ *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

a bottom surface of the substrate [100] and a bottom surface of the ink chamber [112 and 113] shown in Figs. 6-9 and below.

(Office Action Made Final mailed October 26, 2006, paragraph no. 3, page 7).

Appellants respectfully disagree with the Examiner's characterization of the Silverbrook reference. Feature 114 of the Silverbrook reference is a nozzle channel, not a restrictor.¹⁷ The nozzle channel 114 is a large channel relative to the adjoining nozzle barrel 113. Rather than acting as a restrictor, the nozzle channel 114 does just the opposite, as it is significantly *larger* than the nozzle barrel 113, as discussed above in Section (VII)(A)(2). This is clearly shown in drawing FIGS. 6-9 of the Silverbrook reference, which were relied upon by the Examiner in the rejection.

In view of the above, appellants respectfully submit that the Silverbrook reference fails to disclose, or even suggest, the restrictor recited in claim 1 of the instant application. Accordingly, no *prima facie* case of anticipation has been made out with respect to claim 1. Therefore, the rejection of claim 1 under 35 U.S.C. § 102(b) is improper, and appellants respectfully request that it be reversed.

C. The Rejection of Claim 4 as Being Obvious over the Silverbrook Reference in view of the Chan Reference is Improper

Claim 4 stands rejected as being unpatentable under 35 U.S.C. § 103(a) over the Silverbrook reference in view of the Chan reference. Appellants respectfully submit that this rejection is improper and should be reversed.

¹⁷ See the Silverbrook reference at, e.g., col. 6, lines 11-14.

Claim 4 ultimately depends from claim 1.¹⁸ As discussed above in Section (VII)(A), appellants respectfully submit that the combination of the Lim et al., Silverbrook and Chan references fails to disclose or suggest the restrictor recited in claim 1 of the instant application. Accordingly, appellants respectfully submit that combination of just the Silverbrook and Chan references necessarily fails to disclose or suggest the restrictor recited in claim 1, for at least the reasons set forth in Section (VII)(A). Therefore, since claim 1 is believed to be patentable over the combination of the Silverbrook and Chan references, claim 4 is believed to be similarly patentable over these references. Therefore, appellants respectfully submit that the rejection of claim 4 under 35 U.S.C. § 103(a) is improper, and respectfully request that it be reversed.

D. The Rejection of Claim 7 as Being Obvious over the Silverbrook Reference in view of the Lee et al. Reference is Improper

Claim 7 stands rejected as being unpatentable under 35 U.S.C. § 103(a) over the Silverbrook reference in view of the Lee et al. reference. Appellants respectfully submit that this rejection is improper and should be reversed.

Appellants respectfully submit that the combination of the Silverbrook and Lee et al. references fails to disclose or suggest each and every element of claim 7. Claim 1, from which claim 7 depends, recites, *inter alia*, “a restrictor, which is a path through which ink is supplied from an ink reservoir to the ink chamber, perforating a bottom surface of the

¹⁸ Appellants note that claim 4 presently recites a dependency from claim 3, although claim 3 was cancelled by the Amendment under 37 C.F.R. § 1.116 that was filed December 19, 2006. Appellants intended the Amendment under 37 C.F.R. § 1.116 to amend claim 4 so that it depends from claim 1. However, claim 4 was not so amended, and appellants regret this oversight. Claim 3 will be amended to depend from claim 1 in the first response to be filed following resolution of the instant appeal.

substrate and a bottom surface of the ink chamber.” However, the proposed combination of the Silverbrook and Lee et al. references fails to disclose or suggest this aspect of claim 1. As set forth above in Sections (VI)(A)(2) and (VI)(B), the Silverbrook reference fails to disclose or suggest a restrictor. Further, the Lee et al. reference clearly shows that the bottom surface of the substrate is penetrated by an ink manifold, not a restrictor.¹⁹ Thus, the proposed combination of the Silverbrook and Lee et al. references fails to disclose, or even suggest, “a restrictor, which is a path through which ink is supplied from an ink reservoir to the ink chamber, perforating a bottom surface of the substrate and a bottom surface of the ink chamber,” as recited in claim 1 of the instant application.

In view of the above, appellants respectfully submit that the combination of the Silverbrook and Lee et al. references fails to disclose or suggest each and every aspect of claim 1. As claim 7 depends from claim 1, appellants respectfully submit that no *prima facie* case of obviousness has been made out with respect to claim 7. Therefore, the rejection of claim 7 is improper, and appellants respectfully request that it be reversed.

CONCLUSION

Appellants respectfully submit that the cited references fail to disclose, even or suggest, each and every element of the rejected claims. In particular, appellants respectfully submit that the cited references, taken as a whole, fail to so much as suggest “a restrictor, which is a path through which ink is supplied from an ink reservoir to the ink chamber, perforating a bottom surface of the substrate and a bottom surface of the ink chamber,” as

¹⁹ See the Lee et al. reference at, e.g., paragraph [0037], which states, “The manifold 104 [*sic*, 102] is formed on a bottom side of the substrate 100. See also, e.g., drawing FIG. 3 therein.

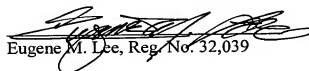
recited in claim 1 of the instant application. In addition, appellants respectfully submit that the Examiner has failed to show that the cited references suggests the desirability of modifying the teachings of the prior art to arrive at the restrictor recited in claim 1.

In view of the above, appellants respectfully submit that the rejection of claims 1, 2 and 4-12 on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-2, 4-7 and 9 of the Lim et al. reference in view of the Silverbrook and Chan references, the rejection of claims 1, 2, 5, 6 and 8 under 35 U.S.C. § 102(b) as being anticipated by the Silverbrook reference, the rejection of claim 4 under 35 U.S.C. § 103(a) as being unpatentable over the Silverbrook reference in view of the Chan reference, and the rejection of claim 7 under 35 U.S.C. § 103(a) as being unpatentable over the Silverbrook reference in view of the Lee et al. reference are each improper. Therefore, appellants respectfully request that these rejections be reversed.

Respectfully submitted,

LEE & MORSE, P.C.

Date: April 20, 2007


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PETITION and
DEPOSIT ACCOUNT CHARGE AUTHORIZATION

This document and any concurrently filed papers are believed to be timely. Should any extension of the term be required, appellants hereby petition the Director for such extension and requests that any applicable petition fee be charged to Deposit Account No. 50-1645.

If fee payment is enclosed, this amount is believed to be correct. However, the Director is hereby authorized to charge any deficiency or credit any overpayment to Deposit Account No. 50-1645.

Any additional fee(s) necessary to effect the proper and timely filing of the accompanying-papers may also be charged to Deposit Account No. 50-1645.

VIII. CLAIMS APPENDIX

The pending claims as they stand on appeal are presented in a listing of the claims, below. Claims 1, 2 and 4-18 are pending in the subject application, of which claims 13-18 are withdrawn from consideration.

Claims 1, 2 and 4-12 are on appeal. Of these, claim 1 is the sole independent claim on appeal.

Listing of the Claims:

1. (Original) An ink-jet printhead, comprising:

a substrate;

an ink chamber to be filled with ink to be ejected formed on an upper surface of the substrate;

a restrictor, which is a path through which ink is supplied from an ink reservoir to the ink chamber, perforating a bottom surface of the substrate and a bottom surface of the ink chamber;

a nozzle plate, which is stacked on the upper surface of the substrate and forms an upper wall of the ink chamber;

a nozzle perforating the nozzle plate at a position corresponding to a center of the ink chamber;

a heater formed in the nozzle plate to surround the nozzle; and

a conductor for applying a current to the heater.

2. (Original) The ink-jet printhead as claimed in claim 1, wherein the restrictor has a length of about 200-750 μm .

3. (Cancelled).

4. (Original) The ink-jet printhead as claimed in claim 3, wherein the heater is formed of one material selected from the group consisting of TaAl, TiN, CrN, W, and polysilicon.

5. (Original) The ink-jet printhead as claimed in claim 1, wherein the conductor is formed of aluminum or an aluminum alloy.

6. (Original) The ink-jet printhead as claimed in claim 1, wherein the nozzle plate includes a plurality of passivation layers.

7. (Original) The ink-jet printhead as claimed in claim 6, wherein the plurality of passivation layers includes a first passivation layer, a second passivation layer, and a third passivation layer, which are sequentially stacked on the substrate, and wherein the heater is disposed between the first passivation layer and the second passivation layer, and the conductor is disposed between the second passivation layer and the third passivation layer.

8. (Original) The ink-jet printhead as claimed in claim 6, wherein each of the plurality of passivation layers is formed of at least one material selected from the group consisting of SiO₂, Si₃N₄, SiC, Ta, Pd, Au, TaO, TaN, Ti, TiN, Al₂O₃, CrN, and RuO₂.

9. (Original) The ink-jet printhead as claimed in claim 6, wherein the nozzle plate further includes a heat dissipating layer stacked on the plurality of passivation layers.

10. (Original) The ink-jet printhead as claimed in claim 9, wherein the heat dissipating layer defines an upper portion of the nozzle and is formed of a metallic material having thermal conductivity to dissipate heat generated by the heater and heat remaining around the heater.

11. (Original) The ink-jet printhead as claimed in claim 10, wherein the heat dissipating layer is formed of at least one material selected from the group consisting of Ni, Fe, Au, Pd, and Cu.

12. (Original) The ink-jet printhead as claimed in claim 9, wherein the heat dissipating layer has a thickness greater than about 10 μm .

13. (Withdrawn) A method for manufacturing an ink-jet printhead, comprising:

- (a) preparing a substrate;
- (b) sequentially stacking a plurality of passivation layers on the substrate and forming a heater and a conductor connected to the heater between adjacent passivation layers;
- (c) forming a heat dissipating layer on the plurality of passivation layers and forming a nozzle perforating the passivation layers and the heat dissipating layer;
- (d) etching a bottom surface of the substrate and forming a restrictor in communication with an ink reservoir; and
- (e) etching the substrate exposed through the nozzle to be in communication with the restrictor and forming an ink chamber to be filled with ink.

14. (Withdrawn) The method as claimed in claim 13, wherein sequentially stacking the plurality of passivation layers on the substrate and forming the heater and the conductor connected to the heater between adjacent passivation layers comprises:

- forming a first passivation layer on an upper surface of the substrate;
- forming the heater on the first passivation layer;
- forming a second passivation layer on the first passivation layer and the heater;
- forming the conductor on the second passivation layer; and
- forming a third passivation layer on the second passivation layer and the conductor.

15. (Withdrawn) The method as claimed in claim 13, wherein forming the heat dissipating layer on the plurality of passivation layers and forming the nozzle perforating the plurality of passivation layers and the heat dissipating layer comprises:

patterning the plurality of passivation layers and exposing an upper surface of the substrate;

forming a sacrificial layer for forming the nozzle on the exposed substrate;

forming a heat dissipating layer on the plurality of passivation layers; and

removing the sacrificial layer and forming the nozzle.

16. (Withdrawn) The method as claimed in claim 15, wherein the sacrificial layer is formed of a photoresist.

17. (Withdrawn) The method as claimed in claim 15, wherein the heat dissipating layer is formed by electroplating.

18. (Withdrawn) The method as claimed in claim 15, wherein the heat dissipating layer has a thickness greater than about 10 μm .

IX. EVIDENCE APPENDIX

Appellants make no reference to extrinsic evidence.

X. RELATED PROCEEDINGS APPENDIX

To the best of appellants' knowledge, there are no prior or pending appeals, interferences or judicial proceedings which may be related to, directly affect or be directly affected by, or have a bearing on the Board's decision in the pending appeal.